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Effect of Pumpkin Seed on Male and Female Reproductive Health

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Abstract

This review article explores the effects of pumpkin seeds on male and female fertility based on existing research. Studies have shown promising results regarding the influence of pumpkin seeds on sperm quality, quantity, motility, menstrual regularity, ovulation, hormonal balance, and reproductive health outcomes in both men and women. The mechanisms through which pumpkin seeds show their effect rich content of essential nutrients, antioxidants, and bioactive compounds. While more research is needed to fully understand the impact of pumpkin seeds on fertility, incorporating them into a balanced diet may offer valuable benefits for individuals looking to enhance their reproductive health.

INTRODUCTION

Pumpkin seeds (Cucurbita pepo), commonly known as pepitas, are no longer just a fall snack, they're a superfood enjoyed all over the world. The seeds are very flat,

pointed at one end and have a chewy texture. The rich nutritional content are valued as food and medicine for over 3,000 years. This review article provides the scientific studies about the pumpkin seed composition and health benefits. Fertility and the ability to conceive and bear children is a process, which depends on a hormonal equilibrium, lifestyle, age, and nutrition. The natural food source to promote reproductive health is pumpkin seeds (pepitas). They are packed with fertility-friendly nutrients like zinc, magnesium, antioxidants and essential fatty acids, all of which are associated with better fertility in both men and women. *(Marek at el,.2016)*

Reproductive capacity is influenced by a complex interplay of genetic predispositions, environmental exposures, lifestyle practices and nutritional status, all of which collectively determine fertility outcomes in both men and women. Pumpkin seed oil an emerald-tinged, ruby-hued extract obtained via cold-pressing the flattened kernels of Cucurbita pepo L. is particularly rich in health-promoting unsaturated lipids, with oleic and linoleic acids predominating, alongside a noteworthy concentration of plant-derived sterols. Recent randomized and observational clinical investigations have begun to evaluate this oil as an adjunctive intervention for conditions such as benign prostatic hyperplasia, overactive bladder syndrome and androgenetic alopecia. The favorable outcomes reported in these trials are thought to derive from the oil's synergistic blend of phytoestrogens and essential fatty acids: mechanistic studies suggest that pumpkin seed oil can inhibit 5α-reductase activity, thereby preventing the conversion of testosterone to dihydrotestosterone, as well as exert anti-inflammatory effects and scavenge reactive oxygen species to protect cellular integrity. Additionally, smooth-muscle relaxation of the detrusor and sphincter muscles within the lower urinary tract appears to facilitate more complete and comfortable voiding, offering

symptomatic relief to individuals both male and female experiencing difficulty initiating or sustaining urination. Beyond its urological and dermatological applications, the seeds themselves serve dual purposes as a nutrient-dense snack and as the source for a premium salad oil. Analytical profiles consistently report that linoleic and oleic acids constitute the majority of its fatty acid spectrum, while saturated lipids such as palmitic and stearic acids remain present at comparatively lower concentrations (Murkovic et al., 2000).

Nutrition play's important role in overall health and well-being, including its significant impact on fertility. Fertility is not only important at an individual level for those seeking to conceive but also holds societal implications concerning population growth and demographic trends. Dietary factors can influence fertility outcomes therefore essential in promoting reproductive health. This review article aims to investigate the effects of pumpkin seeds specifically on male and female fertility.

NUTRIENT PROFILE

Crunchy pumpkin seeds, or pepitas, represent not only a palatable snack but also a dense reservoir of vital nutrients. Their incorporation into dietary regimens can support reproductive health by supplying essential macro- and micronutrients. Beyond macronutrients, pepitas are also abundant in magnesium, zinc and iron, which are vital cofactors in enzymatic reactions and reproductive function.

MACRONUTRIENT COMPOSITION

Pumpkin seeds deliver significant plant-protein, crucial for tissue regeneration and hormone synthesis; a 28-gram portion yields approximately nine grams of protein, making it valuable for omnivores and those following vegetarian diets alike. These seeds are distinguished by substantial lipid and protein levels (Kotecka-Majchrzak et al., 2020),

boasting abundant monounsaturated and polyunsaturated fats including omega-6 linoleic acid and omega-3 alpha-linolenic acid which maintain cellular membrane integrity and serve as precursors for hormone biosynthesis. The anti-inflammatory and endocrine-modulating properties of omega-3 fatty acids further enhance hormonal equilibrium (Samec et al., 2022). With minimal carbohydrate content, mostly complex starches and dietary fiber, pumpkin seeds aid in stabilizing blood glucose and contribute to endocrine stability (Samec et al., 2022).

MICRONUTRIENTS

Zinc: Low zinc levels can be a major cause of having difficulty getting pregnant, it is a major mineral for fertility. It is important for hormone production, your immune system and the production of healthy sperm and eggs. For men, zinc is important because it boosts testosterone production and sperm motility. In women, zinc helps regulate menstrual cycle and ovulation. Magnesium serves as a cofactor in hundreds of enzymatic pathways throughout various body tissues, and is recognized as a critical mineral in reproductive health. It supports glucose homeostasis, promotes smooth-muscle relaxation (vital for uterine function) and maintains hormonal equilibrium. Vitamin E functions as a potent antioxidant, helping safeguard cellular membranes against oxidative injury.

It is an important antioxidant also in regards to fertility as it protects sperm and eggs from oxidative damage, which is associated with damaged DNA and a decline in fertility *(link Samec at el,.2022).* Iron is crucial for making hemoglobin and red blood cells, which transport oxygen to the reproductive organs. Sufficient iron levels are important for healthy ovarian function and regular menstrual cycles in women. Pumpkin seeds are also high in plant sterols. Research shows these can support hormone balance

and may lower the risk of issues like endometriosis and fibroids. Antioxidants: Besides vitamin E, pumpkin seeds have other antioxidants, including carotenoids and polyphenols. These antioxidants help fight oxidative stress, which is linked to lower fertility in both men and women *(link Samec at el,.2022).*

BIOACTIVE CONSTITUENTS OF PUMPKIN SEED OIL

Pumpkin seed oil is distinguished by its vivid green to reddish coloration, a visual marker of its rich phytochemical content. Analytical profiling reveals that four primary fatty acids—oleic acid (approximately 43.8 %), linoleic acid (around 33.1 %), palmitic acid (circa 13.4 %) and stearic acid (near 7.8 %)—collectively comprise roughly 98 % (±0.1 %) of the oil's total lipid composition. Extraction trials on air-dried Cucurbita pepo seeds demonstrate an average oil yield of 47.03 % by weight, though yields can fluctuate substantially (±10 %) depending on varietal genetics, cultivation conditions and post-harvest processing techniques.

Beyond its lipid fraction, pumpkin seed oil offers a concentrated suite of macronutrients and micronutrients. Each gram contains complete plant-based proteins and a balanced spectrum of long-chain polyunsaturated fatty acids (including omega-3 α-linolenic, omega-6 linoleic and omega-9 oleic acids). It is also a notable source of fat-soluble antioxidants—β- and γ-tocopherols—and carotenoids such as lutein. In addition, the oil harbors significant amounts of phytosterols, chlorophyll derivatives and essential trace elements (notably zinc and selenium), which together support metabolic processes ranging from enzyme function to cellular redox balance.

Phytochemical investigations into Cucurbita maxima have cataloged an extensive array of triterpenoids and sterols present in both seeds and floral tissues. Well-characterized compounds include cucurbita-5,24-dienol, α-amyrin and β-amyrin.

Advanced chromatographic and spectroscopic analyses have further isolated three novel multiflorane-type triterpenes—7α-methoxymultiflor-8-ene-3α,29-diol 3-acetate-29-benzoate; 7-oxomultiflor-8-ene-3α,29-diol 3-acetate-29-benzoate; and multiflora-7,29-diol 3-p-hydroxybenzoate-29-benzoate—alongside previously known multiflorane derivatives such as multiflora-7,9(11)-diene-3α,29-diol 3,29-dibenzoate and multiflora-5,7,9(11)-triene-3α,29-diol 3,29-dibenzoate.

The synergistic interplay of bioactive constituents in pumpkin seed oil underpins its broad health potential. High zinc content confers potent antioxidant activity by quenching reactive oxygen species and inhibiting metal-catalyzed lipid peroxidation. Empirical studies report immunomodulatory effects, with seed extracts demonstrating supportive effects in reproductive and metabolic disorders. Moreover, the optimal omega-3 to omega-6 fatty acid ratio contributes to cardiovascular homeostasis, cognitive function and inflammatory regulation. Preliminary clinical and preclinical data further indicate symptomatic relief in lower urinary tract dysfunction and prostate hypertrophy, highlighting the oil's promise as a nutraceutical adjunct (Shaban et al., 2017)

PUMKIN SEED AND MALE FERTILITY

TESTOSTERONE LEVELS

Testosterone is the main male sex hormone. It is crucial for sperm production and sexual health. Zinc, a mineral found in pumpkin seeds, is vital for making testosterone. Research shows that taking zinc supplements can boost testosterone levels, especially in people who do not get enough of it. Moreover, the healthy fats in pumpkin seeds, such as omega-3 and omega-6 fatty acids, are important for keeping hormone levels stable.

These fats help manage the production of sex hormones and might improve fertility in men *(Njoku at el,.2021).*

Component in Pumpkin Seeds	Effect on Male Fertility	Mechanism / Benefit
Zinc	Increases sperm count and motility	Zinc is essential for testosterone production and sperm development
Magnesium	Improves testosterone levels and overall reproductive health	Involved in hormone regulation and energy production
Antioxidants (Vitamin E, Selenium)	Protects sperm from oxidative stress	Reduces sperm DNA damage and improves sperm viability
Omega-3 fatty acids	Enhances blood flow to reproductive organs	Supports erectile function and sperm membrane flexibility
Phyto-sterols	May help improve prostate health	Indirectly supports fertility by improving semen quality
Arginine (an amino acid)	Improves sperm motility	Enhances nitric oxide production, improving blood flow and sperm movement
Anti-inflammatory properties	Supports hormonal balance	Reduces inflammation that may affect fertility-related organs
L-tryptophan	Reduce stress	Helps in serotonin production, promoting mood and sexual drive

REDUCING OXIDATIVE STRESS

OXIDATIVE STRESS AND MALE GAMETE INTEGRITY

Oxidative stress arises when the generation of reactive oxygen species outpaces the body's antioxidant defenses, resulting in cellular injury. In the male reproductive context, excessive free radicals compromise spermatozoal membranes, diminish motility parameters and induce strand breaks in nuclear DNA, thereby undermining fertility potential. Pumpkin seeds are particularly rich in endogenous antioxidants including tocopherols (vitamin E isoforms), carotenoid pigments and diverse polyphenolic compounds which collectively scavenge free radicals and reinforce spermatozoal resilience against oxidative insult. For example, a rigorously controlled trial published in the Journal of Medicinal Food observed that daily pumpkin seed extract supplementation significantly enhanced sperm concentration and progressive motility, alongside statistically significant reductions in oxidative stress biomarkers in seminal plasma.

CLINICAL EVALUATION OF PUMPKIN SEED OIL IN BENIGN PROSTATIC HYPERPLASIA

A single-blind, randomized clinical trial at the Urology Clinic of Shaheed Beheshti Hospital in Hamadan, Iran (August 23, 2019–February 19, 2020) enrolled men aged 50 years and older with symptomatic BPH. Participants were randomized to receive either 0.4 mg tamsulosin nightly or 360 mg pumpkin seed oil twice daily. Baseline anthropometric measures—including age, height, weight and BMI—were recorded. The International Prostate Symptom Score (IPSS) was assessed at baseline, one month and three months after treatment initiation. Secondary endpoints—BPH-related quality of life, serum prostate-specific antigen, prostate volume, post-void residual urine volume

and maximum urinary flow rate—were measured at baseline and three months. Adverse effects were documented throughout. Pumpkin seed oil was well tolerated and provided symptom relief, although its efficacy did not reach that of tamsulosin (Zerafatjou et al., 2021).

PRECLINICAL MODELS OF PROSTATIC HYPERPLASIA

Two complementary animal studies have further explored the anti-hyperplastic potential of pumpkin seed components. In one investigation, Wistar rats received oral citral to induce ventral prostate enlargement. Administration of a diet containing 10% ground pumpkin seed inhibited citral-induced prostate hyperplasia, evidenced by reduced ventral prostate weight, lower protein-bound prostatic antigen levels and preservation of normal testicular histoarchitecture (Abdel-Rahman et al., 2006). A separate study divided forty adult Wistar rats into five groups vehicle control, testosterone propionate (T-P) only, T-P plus pumpkin seed oil, and T-P plus pumpkin seed oil with added phytosterol F. After two weeks, the prostatic weight–to–body weight ratio was calculated postmortem, total protein concentrations in prostatic tissue were quantified via colorimetric assay, and histological sections were examined following hematoxylin–eosin staining. These findings corroborated the anti-proliferative and tissue-protective effects of pumpkin seed oil in hormonally induced prostatic growth (Tsai et al., 2006).

PUMPKIN SEED AND FEMALE FERTILITY

The benefits of pumpkin seeds for female fertility are significant. The nutrients in pumpkin seeds, such as zinc, magnesium, and healthy fats, support different aspects of female reproductive health. This includes menstrual regulation and ovarian function.

Hormonal Regulation and Menstrual Health: Zinc is important for regulating the menstrual cycle. It helps with the production of estrogen and progesterone, which are

key hormones in ovulation and menstruation. Having enough zinc is crucial for keeping a regular menstrual cycle and avoiding irregular periods, as these can indicate hormonal imbalances. *(Arora at el,.2023)*

Cycle Phase	Days	Seeds to Eat Daily	Hormone Supported	Key Benefits
Follicular Phase	Day 1–14	1 tbsp Pumpkin Seeds 1 tbsp Flax Seeds	**Estrogen**	Supports follicle development, balances estrogen, prepares for ovulation
Ovulation	Around Day 14	Transition phase	**Hormonal shift**	Body naturally transitions from estrogen to progesterone
Luteal Phase	Day 15–28	1 tbsp Sesame Seeds 1 tbsp Sunflower Seeds	**Progesterone**	Supports uterine lining, reduces PMS, maintains cycle balance

Pumpkin seeds are a rich botanical source of phytoestrogens, plant-derived compounds that mimic endogenous estrogen activity. These bioactive molecules bind to estrogen receptors, influencing the regulation of female reproductive cycles and secondary sexual characteristics. Estrogen itself is central to coordinating menstrual regularity, facilitating ovarian function and supporting endometrial proliferation. Furthermore, it contributes

to skeletal integrity by promoting bone mineralization and mediates lipid transport by modulating cholesterol homeostasis. Through its impact on lipid metabolism, estrogen helps maintain optimal ratios of high-density and low-density lipoproteins, thereby mitigating cardiovascular risk. Additionally, estrogen governs mammary gland development and the proliferation of uterine epithelial cells. The synergistic presence of phytoestrogens and tocopherols in pumpkin seed oil offers a valuable natural resource for women's hormonal balance, providing antioxidant protection and hormone-mimetic support. Consequently, dietary inclusion of pumpkin seed derivatives may enhance endocrine function and overall female health.

EVIDENCE- BASED HEALTH BENEFITS

1. Heart Health; Pumpkin seeds improve lipid profiles by decreasing LDL cholesterol and triglycerides and increasing HDL. Magnesium and potassium aid in regulating blood pressure, while arginine boosts nitric oxide synthesis, facilitating vasodilation.
2. Prostate and Urinary Well-being; Phyto-Sterols (especially beta-sitosterol) block 5-alpha-reductase, alleviating symptoms of benign prostatic hyperplasia (BPH). Research indicates enhanced urinary flow and decreased inflammation in patients with BPH.
3. Antioxidant and Anti-Inflammatory Properties; Phenolic compounds and vitamin E counteract free radicals, lowering oxidative stress. Research on animals indicates decreased inflammation in arthritis models, linked to and fatty acids.
4. Blood Sugar Regulation; Research involving animals and humans indicates that pumpkin seed extracts may improve insulin sensitivity and lower blood glucose levels, likely attributed to their magnesium and antioxidant properties.

5. Regulation of Sleep and Mood Tryptophan converted into serotonin and melatonin and enhance the sleep quality. The magnesium helps to relax the muscles.

USED IN DIET

- Try sprinkling seeds onto salads, soups or toast
- Add seeds to your smoothies, porridge and cereal
- Experiment with new sauces and dressings - add some sesame seeds into your salad dressings or even replace the traditional pine nuts in pesto for sunflower seeds.
- Try out different seed butters - drizzle some sunflower seed butter over your porridge in the morning or serve with apples for a great snack
- Make this PCOS and fertility friendly granola- packed with wholegrains, seeds and nuts

CONCLUSION

Pumpkin seeds represent a remarkably concentrated source of essential nutrients, with a robust evidence base supporting their cardioprotective, prostate-health, metabolic and immunomodulatory properties. Their lipid fraction rich in unsaturated fatty acids such as linoleic and oleic acids combined with high levels of plant sterols, magnesium, zinc and other trace minerals, underpins benefits for vascular function, lipid metabolism and inflammatory balance. Additionally, pumpkin seeds deliver substantial amounts of high-quality plant proteins, dietary fiber and an array of antioxidant phytochemicals (including tocopherols, carotenoids and polyphenols), positioning them as both a preventive and adjunctive therapeutic food. Incorporation of shelled pumpkin seeds or their cold-pressed oil into daily meal plans offers an accessible strategy for bolstering

nutrient intake and supporting systemic health, though further rigorously controlled human trials are warranted to establish optimal dosing, bioavailability and long-term outcomes. In synthesis, pumpkin seeds emerge as a micro-scale powerhouse: they concentrate vitamins (e.g., riboflavin, folate, β-carotene), minerals (iron, calcium, zinc), essential omega-3 and omega-6 fatty acids, proteins and potent antioxidants that collectively reduce oxidative stress, improve ocular health, modulate cholesterol profiles and may lower the incidence or progression of malignancies such as breast, prostate, lung, colon and gastric cancers.

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